



FCC RF Test Report

APPLICANT : Lenovo (Shanghai) Electronics Technology Co., Ltd.
EQUIPMENT : Tablet PC
BRAND NAME : Lenovo
MODEL NAME : Lenovo Miix 630-12Q35; 81F1
FCC ID : O57MIIX630
STANDARD : FCC Part 15 Subpart E §15.407
CLASSIFICATION : (NII) Unlicensed National Information Infrastructure

The product was received on Dec. 12, 2017 and testing was completed on Mar. 06, 2018. We, Sporton International (Kunshan) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

This report contains data that were produced under subcontract by Laboratory SPORTON INTERNATIONAL INC.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Kunshan) Inc., the test report shall not be reproduced except in full.

James Huang



Approved by: James Huang / Manager

Sporton International (Kunshan) Inc.

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR7D1210E	Rev. 01	Initial issue of report	Apr. 16, 2018



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.403(i)	6dB, 26dB and 99% Occupied Bandwidth	> 500kHz	Pass	-
3.2	15.407(a)	Maximum Conducted Output Power	≤ 30 dBm	Pass	-
3.3	15.407(a)	Power Spectral Density	≤ 30 dBm/500kHz	Pass	-
3.4	15.407(b)	Unwanted Emissions	15.407(b)(4)(i) & 15.209(a)	Pass	Under limit 11.26 dB at 956.60 MHz
3.5	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 12.30 dB at 0.180 MHz
3.6	15.407(c)	Automatically Discontinue Transmission	Discontinue Transmission	Pass	-
3.7	15.203 & 15.407(a)	Antenna Requirement	N/A	Pass	-



1 General Description

1.1 Applicant

Lenovo (Shanghai) Electronics Technology Co., Ltd.

NO.68 BUILDING, 199 FENJU RD, China (Shanghai) Pilot Free Trade Zone, 200131, CHINA

1.2 Manufacturer

Lenovo PC HK Limited

23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong Kong

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Tablet PC
Brand Name	Lenovo
Model Name	Lenovo Miix 630-12Q35; 81F1
FCC ID	O57MIIX630
EUT supports Radios application	WCDMA/HSPA/DC-HSDPA/ HSPA+ (16QAM uplink is not supported)/LTE WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth v3.0+EDR/ Bluetooth v4.0 LE/ Bluetooth v4.1 LE / Bluetooth v 4.2 LE
HW Version	81835_1_14
SW Version	16299.192 windows 10S
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification			
Tx/Rx Channel Frequency Range	5745 MHz ~ 5825 MHz		
Maximum Output Power	<5745 MHz ~ 5825 MHz> SISO<Ant. 1> 802.11a : 17.09 dBm / 0.0512 W SISO<Ant. 2> 802.11a : 17.05 dBm / 0.0507 W MIMO <Ant. 1 + 2> 802.11n HT20 : 18.68 dBm / 0.0738 W 802.11n HT40 : 18.48 dBm / 0.0705 W 802.11ac VHT80: 18.49 dBm / 0.0706 W		
99% Occupied Bandwidth	SISO<Ant. 1> 802.11a : 17.58 MHz MIMO <Ant. 1 + 2> 802.11n HT20 : 18.83 MHz 802.11n HT40 : 36.56 MHz 802.11ac VHT80 : 75.76 MHz		
Type of Modulation	802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)		
Antenna Type / Gain	<Ant. 1> : Monopole Antenna with gain 0.10 dBi <Ant. 2> : Monopole Antenna with gain 1.10 dBi		
Antenna Function Description		Ant. 1	Ant. 2
	802.11 a/n/ac SISO	V	V
	802.11 n/ac MIMO	V	V

Note: For 802.11n HT20 / ac VHT20 and 802.11n HT40 / ac VHT40 mode, the whole testing is assessed only 802.11n HT20/ HT40 by referring to their higher conducted power.

1.5 Modification of EUT

No modifications are made to the EUT during all test items.



1.6 Testing Location

Sporton International (Kunshan) Inc. is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600155-0) and the FCC designation No is CN5013.

Test Site	Sporton International (Kunshan) Inc.		
Test Site Location	No.3-2 Ping-Xiang Rd, Kunshan Development Zone Kunshan City Jiangsu Province 215335 China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.		FCC Test Firm Registration No.
	TH01-KS	CO01-KS	630927

SPORTON INTERNATIONAL INC. is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW0007 under the FCC-recognized accredited testing laboratories by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.		
Test Site Location	No.58, Aly. 75, Ln. 564 Wenhua 3rd Rd. Guishan Dist. TEL: +886-3-327-3456 FAX: +886-3-328-4978		
Test Site No.	Sporton Site No.		FCC Test Firm Registration No.
	03CH07-HY		214511

Note:

1. The test site complies with ANSI C63.4 2014 requirement.
2. Test data subcontracted: radiated spurious emissions for section 3.4 of this report.



1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC Part 15 Subpart E
- ♦ FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ♦ FCC KDB 644545 D03 Guidance for IEEE 802 11ac New Rules v01
- ♦ ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases were recorded in this report.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5725-5850 MHz Band 4 (U-NII-3)	149	5745	157	5785
	151*	5755	159*	5795
	153	5765	161	5805
	155 [#]	5775	165	5825

Note:

1. The above Frequency and Channel in "*" were 802.11n HT40/11ac VHT40.
2. The above Frequency and Channel in "[#]" were 802.11ac VHT80.

2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

SISO Mode

Modulation	Data Rate
802.11a	6 Mbps

MIMO Mode

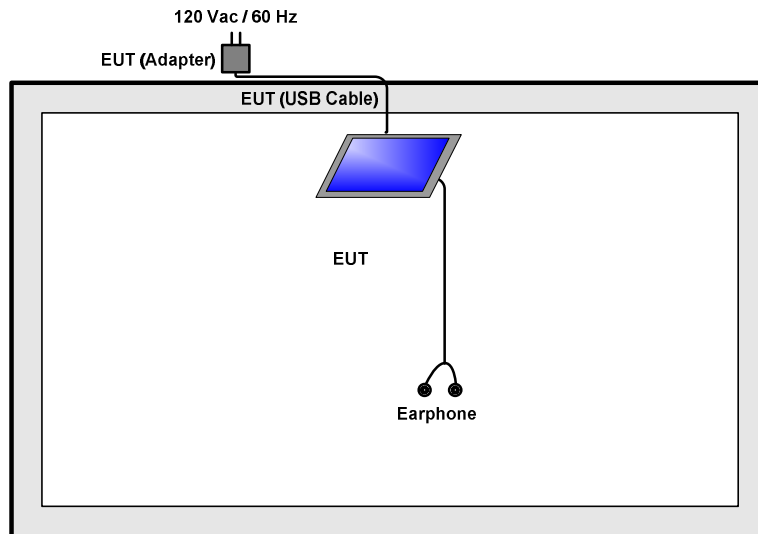
Modulation	Data Rate
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT80	MCS0

AC Conducted Emission	Mode 1 : Bluetooth Link + WLAN (5 G) Link + Camera Front + SD Card Data Copy + Keyboard + Play H Plane + Pen + Earphone + Adapter 1 With Type C for Sample 1
Remark: For Radiated Test Cases, The tests were performance with Adapter 1, Earphone for Sample 1.	

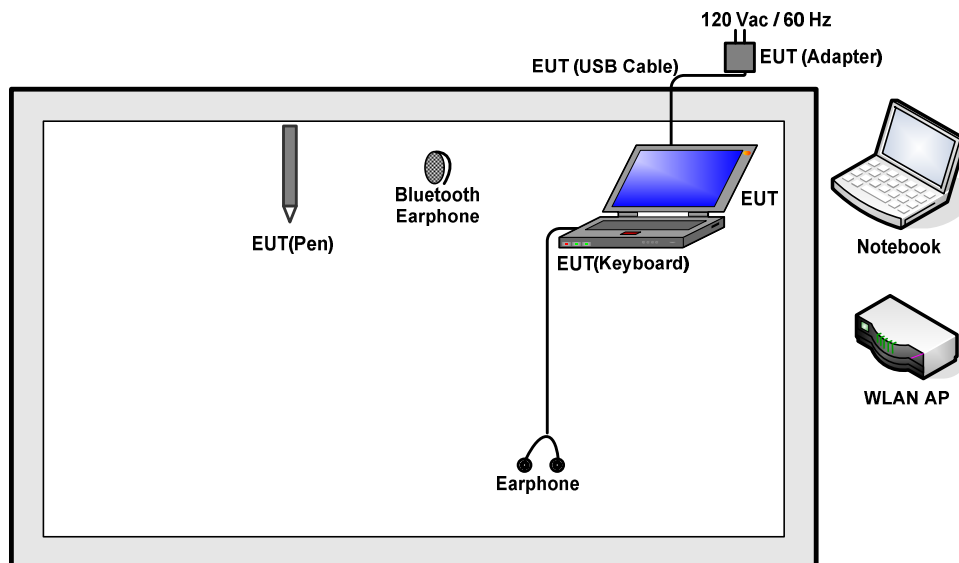
Ch. #		Band IV : 5725-5850 MHz			
		802.11a	802.11n HT20	802.11n HT40	802.11ac VHT80
L	Low	149	149	151	-
M	Middle	157	157	-	155
H	High	165	165	159	-

2.3 Connection Diagram of Test System

<WLAN Tx Mode>



<AC Conducted Emission Mode>



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Earphone	Lenovo	LBH308	N/A	N/A	N/A
2.	WLAN AP	D-link	DIR-855	KA2DIR855A2	N/A	Unshielded, 1.8m
3.	Notebook	Lenovo	E41	N/A	N/A	Unshielded, 1.5m
4.	Earphone	Lenovo	P121	N/A	N/A	Unshielded, 1.2m
5.	SD Card	Kingston	8GB	N/A	N/A	N/A

2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuously transmit/receive.

For AC power line conducted emissions, the EUT was set to connect with the Notebook under large package sizes transmission.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss.

Offset = RF cable loss.

Following shows an offset computation example with cable loss 6.8 dB.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)}. \\ &= 6.8 \text{ (dB)}\end{aligned}$$

3 Test Result

3.1 6dB and 26dB and 99% Occupied Bandwidth Measurement

3.1.1 Description of 6dB and 26dB and 99% Occupied Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

26dB and 99% Occupied bandwidth are reporting only.

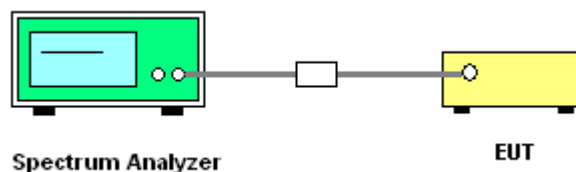
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section C) Emission bandwidth for the band 5.725-5.85GHz
2. Set RBW = 100kHz.
3. Set the VBW $\geq 3 \times$ RBW.
4. Detector = Peak.
5. Trace mode = max hold
6. Measure the maximum width of the emission that is 6 dB down from the peak of the emission.
7. Measure and record the results in the test report.

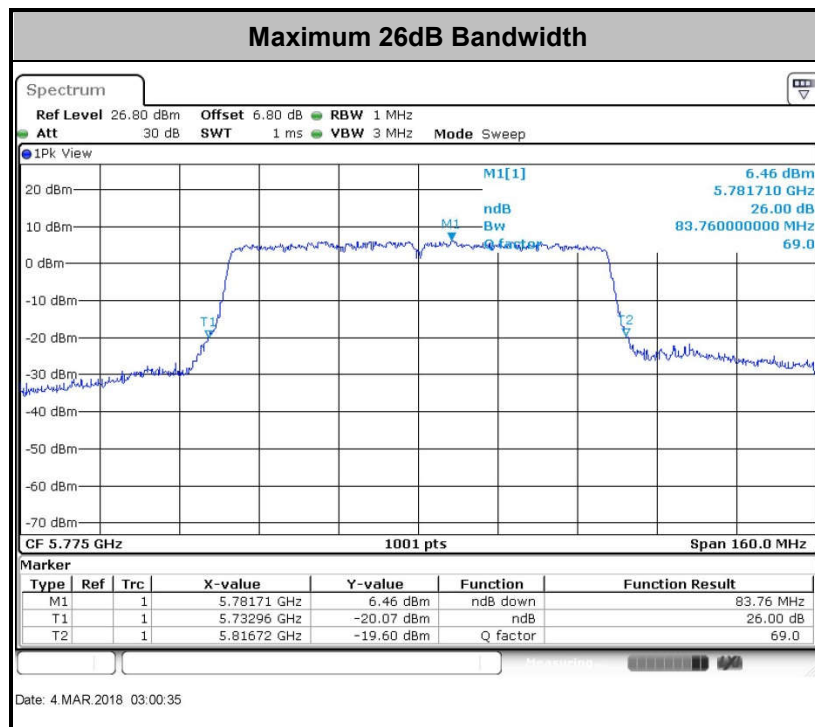
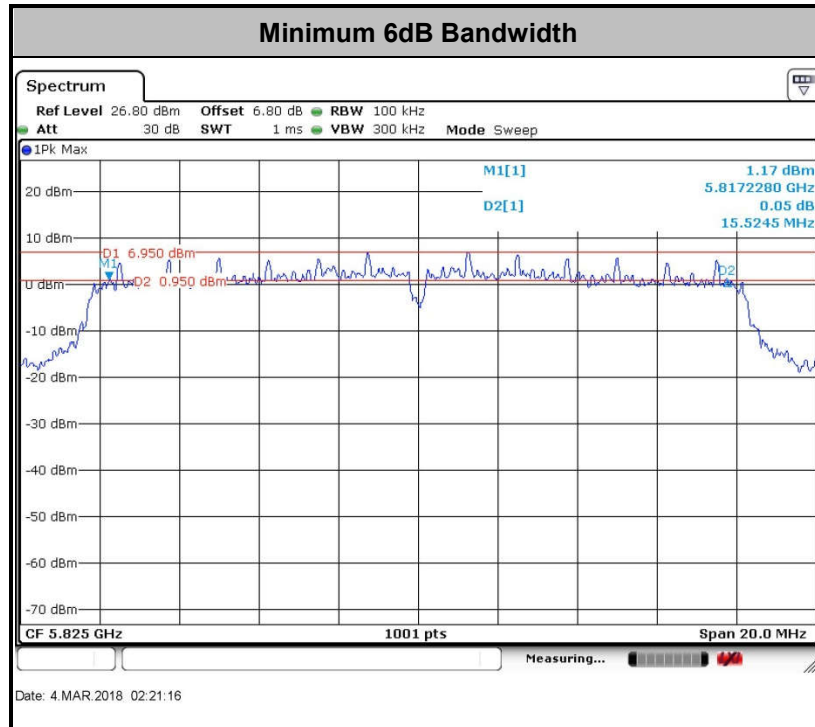
3.1.4 Test Setup

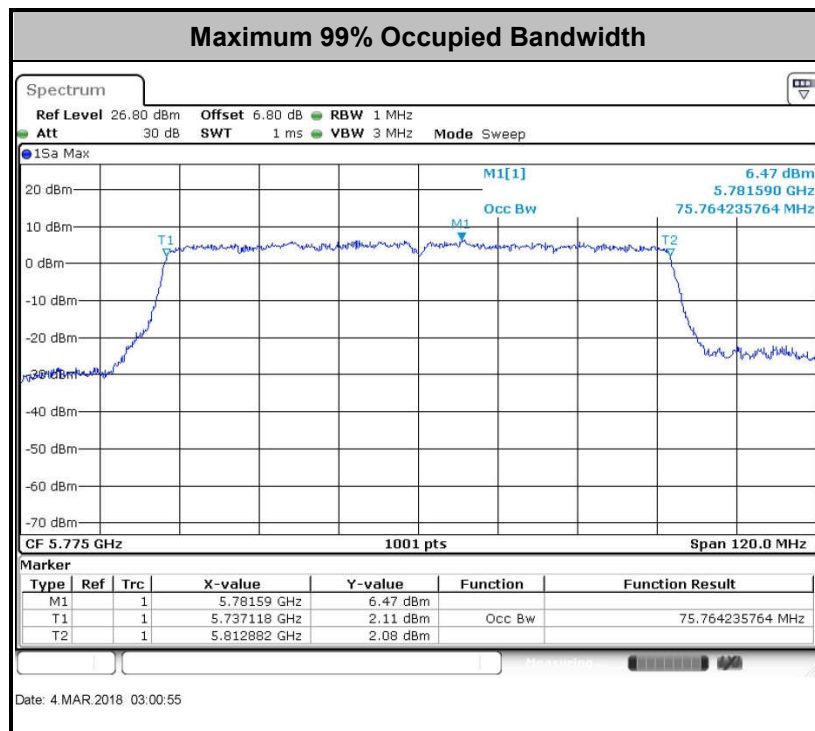




3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.





Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.2 Maximum Conducted Output Power Measurement

3.2.1 Limit of Maximum Conducted Output Power

For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

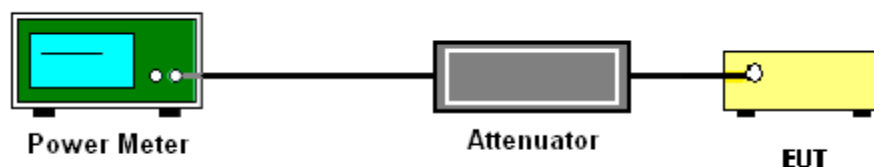
3.2.3 Test Procedures

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Method PM (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, $10 \log(1/x)$, where x is the duty cycle.

3.2.4 Test Setup



3.2.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.



3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

For the band 5.725–5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section F) Maximum power spectral density.

Method SA-2

(trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

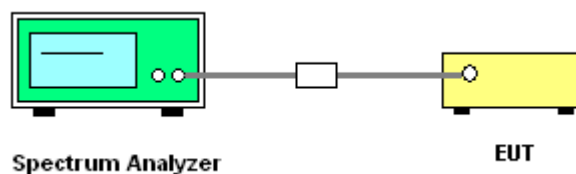
- Measure the duty cycle.
- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 300 kHz.
- Set VBW $\geq$ 1 MHz.
- Number of points in sweep $\geq$ 2 Span / RBW.
- Sweep time = auto.
- Detector = RMS
- Trace average at least 100 traces in power averaging mode.
- Add $10 \log(500\text{kHz}/\text{RBW})$ to the test result.
- Add $10 \log(1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add $10 \log(1/0.25) = 6$ dB if the duty cycle is 25 percent.

1. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
2. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.
3. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

Method (c): Measure and add $10 \log(N_{\text{ANT}})$ dB.

With this technique, spectrum measurements are performed at each output of the device, but rather than summing the spectra or the spectral peaks across the outputs, the quantity $10 \log(N_{\text{ANT}})$ dB is added to each spectrum value before comparing to the emission limit. The addition of $10 \log(N_{\text{ANT}})$ dB serves to apportion the emission limit among the N_{ANT} outputs so that each output is permitted to contribute no more than $1/N_{\text{ANT}}^{\text{th}}$ of the PSD limit.

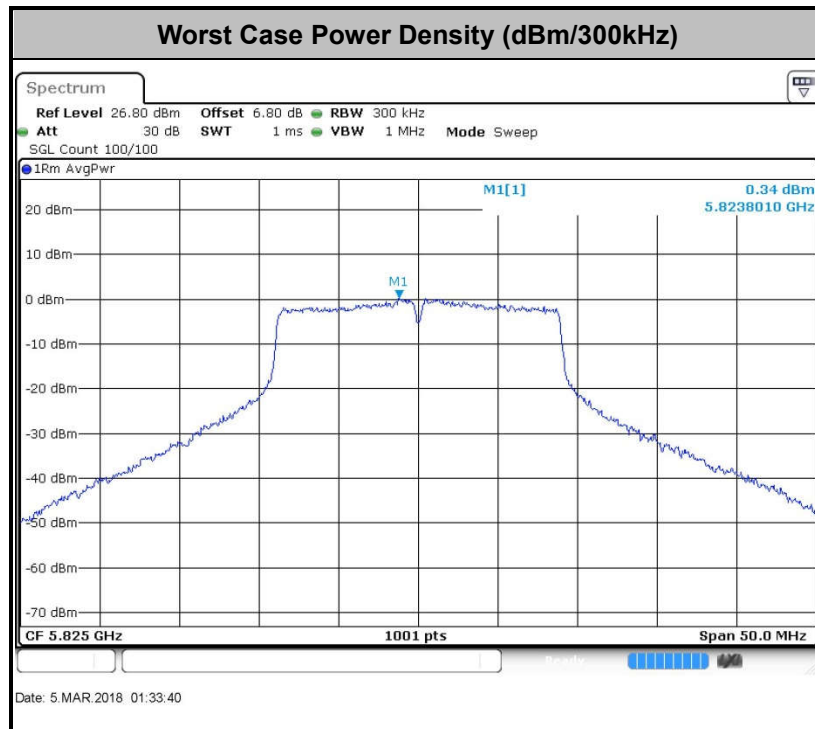
3.3.4 Test Setup





3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



3.4 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.4.1 Limit of Unwanted Emissions

- (1) For transmitters operating in the 5.725-5.85 GHz band:

15.407(b)(4)(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

- (2) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table,

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

Note: The following formula is used to convert the EIRP to field strength.

$$E = \frac{1000000\sqrt{30P}}{3} \text{ } \mu\text{V/m, where P is the eirp (Watts)}$$



EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27	68.3

(3) KDB789033 D02 v02r01 G)2)c)

- (i) Section 15.407(b)(1) to (b)(3) specify the unwanted emission limits for the U-NII-1 and U-NII-2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz.³
- (ii) Section 15.407(b)(4) specifies the unwanted emission limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are in terms of a Peak detector. An alternative to the band emissions mask is specified in Section 15.407(b)(4)(ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the devices using the alternative limit.⁴

Note 3: An out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz peak emission limit.

Note 4: Only devices with antenna gains of 10 dBi or less may be approved using the emission limits specified in Section 15.247(d) till March 2, 2018; all other devices operating in this band must use the mask specified in Section 15.407(b)(4)(i).



3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Section G) Unwanted emissions measurement.

(1) Procedure for Unwanted Emissions Measurements Below 1000MHz

- RBW = 120 kHz
- VBW = 300 kHz
- Detector = Peak
- Trace mode = max hold

(2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

- RBW = 1 MHz
- VBW $\geq$ 3 MHz
- Detector = Peak
- Sweep time = auto
- Trace mode = max hold

(3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

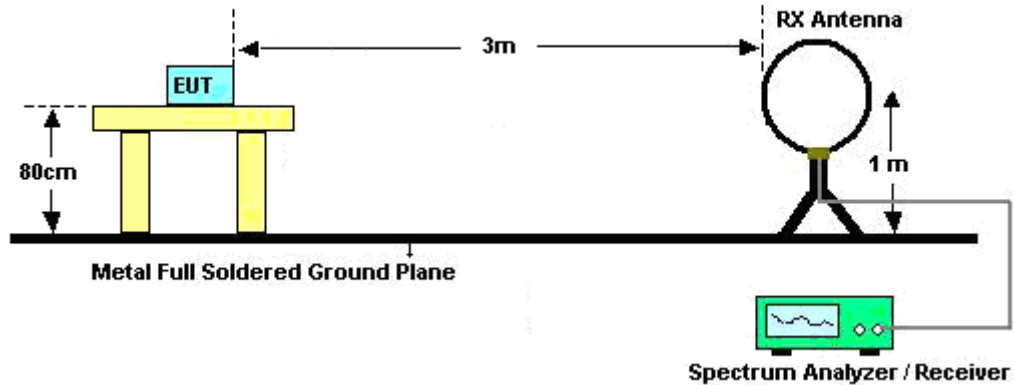
- RBW = 1 MHz
- VBW = 10 Hz, when duty cycle is no less than 98 percent.
- VBW $\geq$ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.



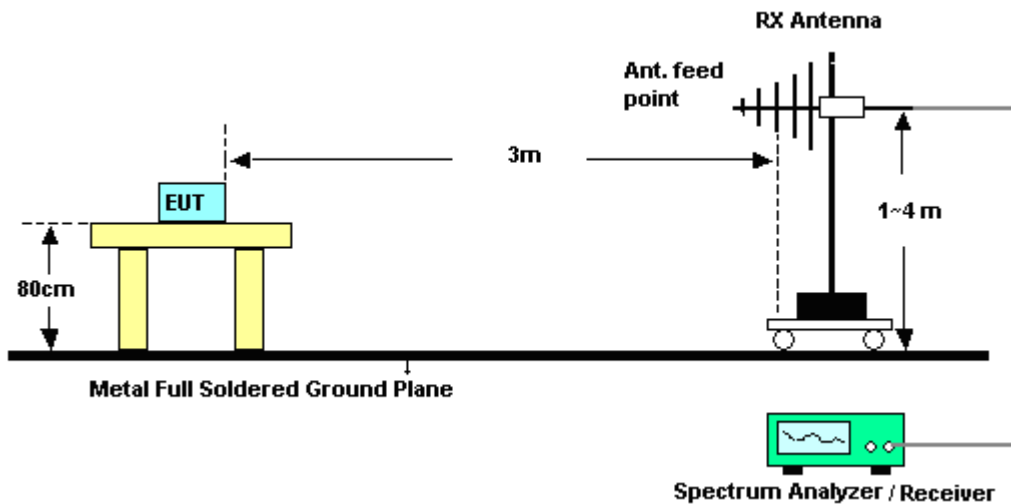
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.4.4 Test Setup

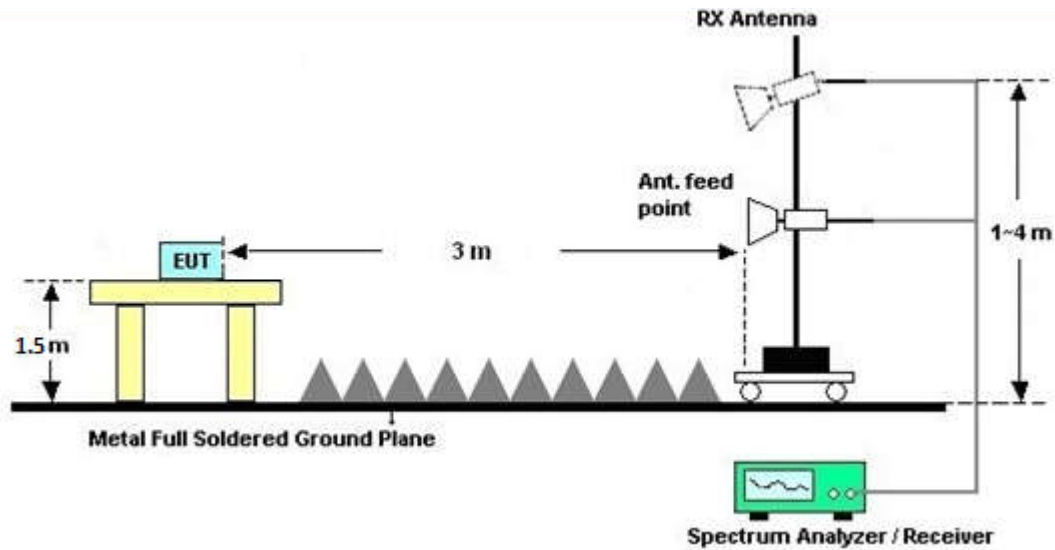
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.4.5 Test Results of Radiated Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

3.4.6 Test Result of Radiated Band Edges

Please refer to Appendix B.

3.4.7 Duty Cycle

Please refer to Appendix C.

3.4.8 Test Result of Unwanted Radiated Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix B.

3.5 AC Conducted Emission Measurement

3.5.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

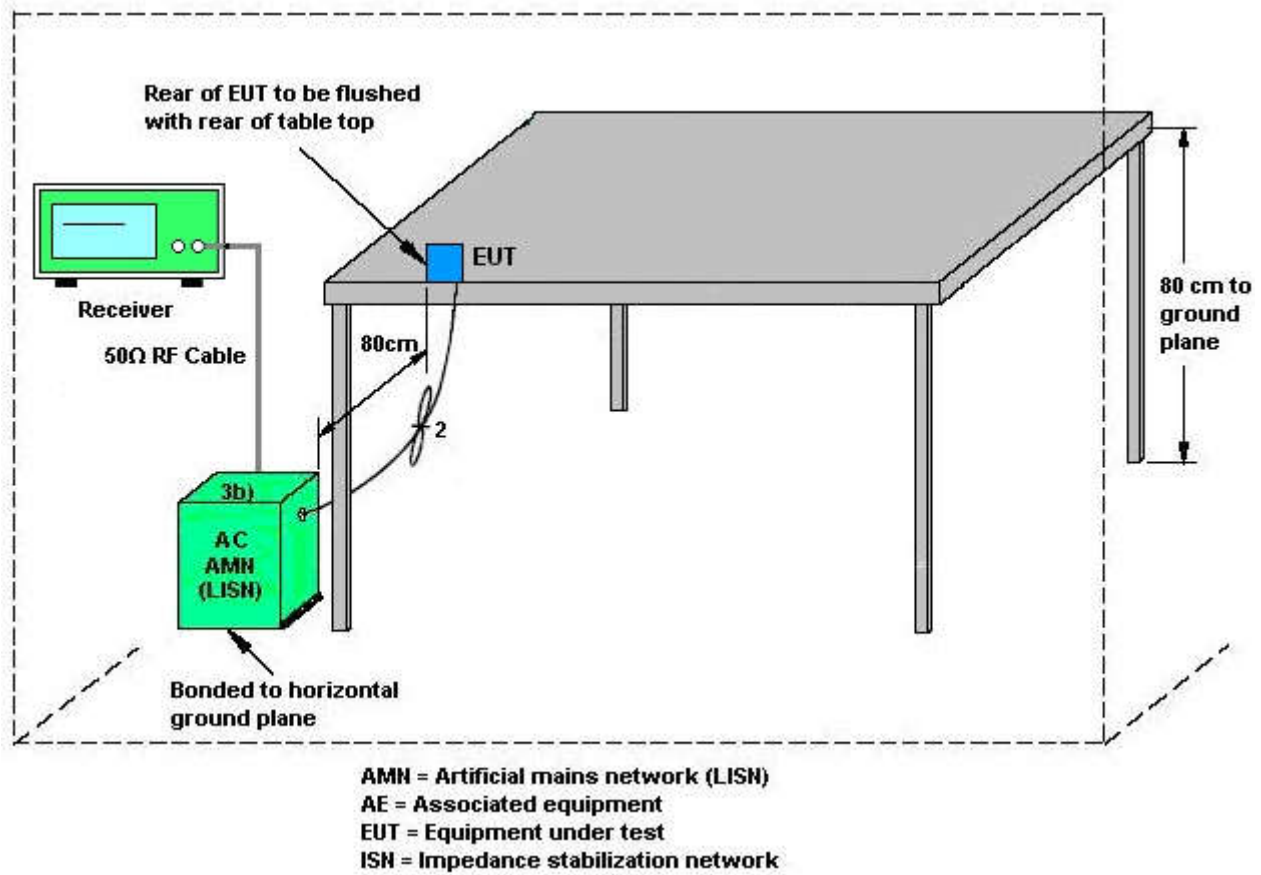
3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

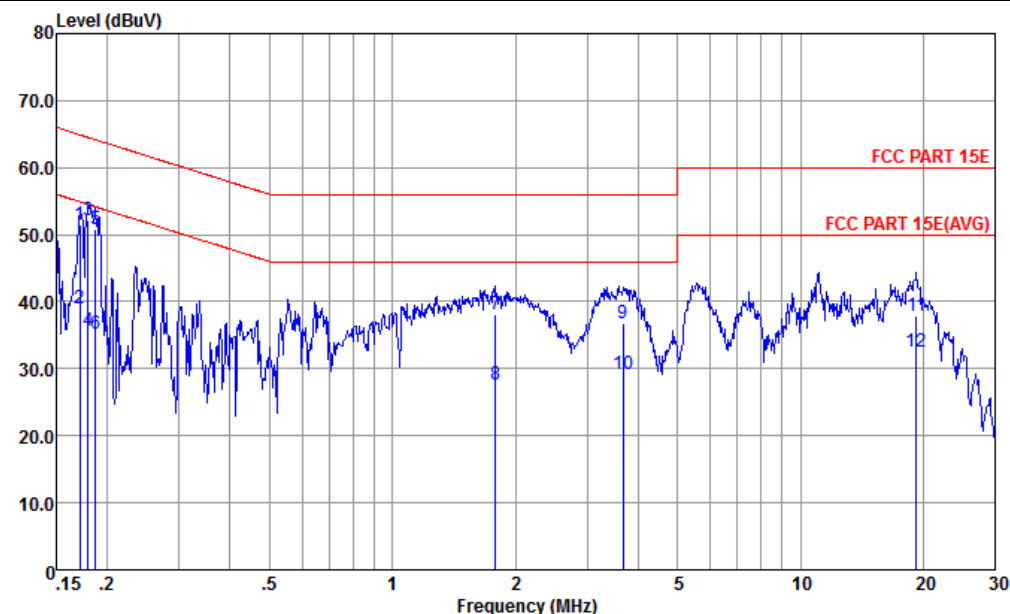
3.5.4 Test Setup





3.5.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	24~25℃
Test Engineer :	Amos Zhang	Relative Humidity :	41~44%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	Bluetooth Link + WLAN (5 G) Link + Camera Front + SD Card Data Copy + Keyboard + Play H Plane + Pen + Earphone + Adapter 1 With Type C for Sample 1		

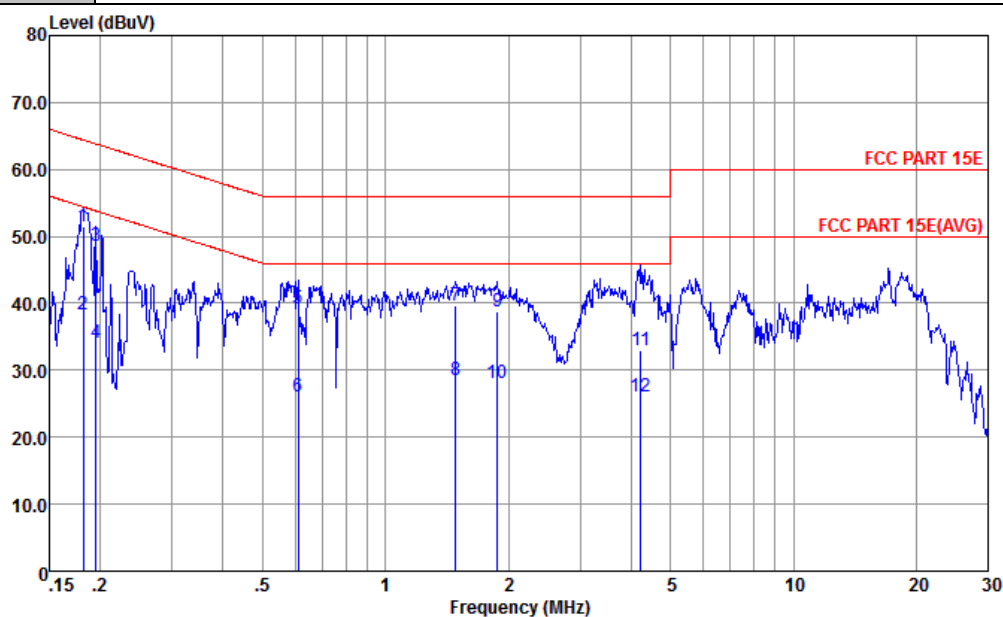


Site : CO01-KS
Condition : FCC PART 15E LISN-L-171013-060103 LINE
mode : Mode 1

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.171	51.42	-13.48	64.90	40.69	0.18	10.55	QP
2	0.171	39.02	-15.88	54.90	28.29	0.18	10.55	Average
3 *	0.180	52.20	-12.30	64.50	41.49	0.19	10.52	QP
4	0.180	35.60	-18.90	54.50	24.89	0.19	10.52	Average
5	0.187	50.88	-13.27	64.15	40.20	0.19	10.49	QP
6	0.187	35.28	-18.87	54.15	24.60	0.19	10.49	Average
7	1.790	38.07	-17.93	56.00	27.59	0.28	10.20	QP
8	1.790	27.67	-18.33	46.00	17.19	0.28	10.20	Average
9	3.681	36.81	-19.19	56.00	26.30	0.34	10.17	QP
10	3.681	29.11	-16.89	46.00	18.60	0.34	10.17	Average
11	19.224	37.86	-22.14	60.00	27.20	0.19	10.47	QP
12	19.224	32.56	-17.44	50.00	21.90	0.19	10.47	Average



Test Mode :	Mode 1	Temperature :	24~25°C
Test Engineer :	Amos Zhang	Relative Humidity :	41~44%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	Bluetooth Link + WLAN (5 G) Link + Camera Front + SD Card Data Copy + Keyboard + Play H Plane + Pen + Earphone + Adapter 1 With Type C for Sample 1		



Site : CO01-KS
Condition : FCC PART 15E LISN-N-171013-060103 NEUTRAL
mode : Mode 1

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1 *	0.182	51.39	-13.03	64.42	40.60	0.28	10.51	QP
2	0.182	38.29	-16.13	54.42	27.50	0.28	10.51	Average
3	0.195	48.65	-15.15	63.80	37.90	0.28	10.47	QP
4	0.195	34.05	-19.75	53.80	23.30	0.28	10.47	Average
5	0.611	39.32	-16.68	56.00	28.80	0.30	10.22	QP
6	0.611	26.12	-19.88	46.00	15.60	0.30	10.22	Average
7	1.487	39.68	-16.32	56.00	29.19	0.32	10.17	QP
8	1.487	28.58	-17.42	46.00	18.09	0.32	10.17	Average
9	1.878	38.82	-17.18	56.00	28.30	0.32	10.20	QP
10	1.878	28.12	-17.88	46.00	17.60	0.32	10.20	Average
11	4.224	33.02	-22.98	56.00	22.50	0.34	10.18	QP
12	4.224	26.12	-19.88	46.00	15.60	0.34	10.18	Average



3.6 Automatically Discontinue Transmission

3.6.1 Limit of Automatically Discontinue Transmission

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization to describe how this requirement is met.

3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.6.3 Test Result of Automatically Discontinue Transmission

While the EUT is not transmitting any information, the EUT can automatically discontinue transmission and become standby mode for power saving. The EUT can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.

3.7 Antenna Requirements

3.7.1 Standard Applicable

If transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

<CDD Modes >

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log(N_{ANT}/N_{SS}=1) dB.

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for N_{ANT} ≤ 4.

Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain;

The EUT supports CDD mode.

For power, the directional gain G_{ANT} is set equal to the antenna having the highest gain, i.e., F)2)f)i).

For PSD, the directional gain calculation is following F)2)f)ii) of KDB 662911 D01 v02r01.

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain "DG" is calculated as following table.

<CDD Modes>						
			DG for Power	DG for PSD	Power Limit Reduction	PSD Limit Reduction
	Ant. 1 (dBi)	Ant. 2 (dBi)	(dBi)	(dBi)	(dB)	(dB)
Band IV	0.10	1.10	1.10	3.62	0.00	0.00

Power limit reduction = Composite gain – 6dBi, (min = 0)

PSD limit reduction = Composite gain + PSD Array gain – 6dBi, (min = 0)



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Aug. 08, 2017	Mar. 04, 2018~ Mar. 05, 2018	Aug. 07, 2018	Conducted (TH01-KS)
Pulse Power Sensor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 18, 2018	Mar. 04, 2018~ Mar. 05, 2018	Jan. 17, 2019	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 18, 2018	Mar. 04, 2018~ Mar. 05, 2018	Jan. 17, 2019	Conducted (TH01-KS)
Thermal Chamber	Ten Billion	TTC-B3S	TBN-960502	-40~+150°C	Oct. 12, 2017	Mar. 04, 2018~ Mar. 05, 2018	Oct. 11, 2018	Conducted (TH01-KS)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Nov. 10, 2017	Mar. 06, 2018	Nov. 09, 2019	Radiation (03CH07-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800 N1D01N-06	35419&03	30MHz to 1GHz	Dec. 18, 2017	Mar. 06, 2018	Dec. 17, 2018	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Aug. 23, 2017	Mar. 06, 2018	Aug. 22, 2018	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz- 40GHz	Nov. 10, 2017	Mar. 06, 2018	Nov. 09, 2018	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz-1GHz	Mar. 14, 2017	Mar. 06, 2018	Mar. 13, 2018	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590075	1GHz ~ 18GHz	Apr. 25, 2017	Mar. 06, 2018	Apr. 24, 2018	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~ 26.5GHz	Oct. 30, 2017	Mar. 06, 2018	Oct. 29, 2018	Radiation (03CH07-HY)
Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 18, 2017	Mar. 06, 2018	Jul. 17, 2018	Radiation (03CH07-HY)
EMI Test Receiver	Agilent	N9038A(MXE)	MY53290053	20Hz to 26.5GHz	Jan. 16, 2018	Mar. 06, 2018	Jan. 15, 2019	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Apr. 17, 2017	Mar. 06, 2018	Apr. 16, 2018	Radiation (03CH07-HY)
Controller	ChainTek	Chaintek 3000	N/A	Control Turn table	N/A	Mar. 06, 2018	N/A	Radiation (03CH07-HY)
Controller	Max-Full	MF7802	MF780208368	Control Ant Mast	N/A	Mar. 06, 2018	N/A	Radiation (03CH07-HY)
Antenna Mast	Max-Full	MFA520BS	N/A	1m~4m	N/A	Mar. 06, 2018	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Mar. 06, 2018	N/A	Radiation (03CH07-HY)
Software	Audix	E3 6.2009-8-24	RK-001042	N/A	N/A	Mar. 06, 2018	N/A	Radiation (03CH07-HY)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 20, 2017	Feb. 02, 2018	Apr. 19, 2018	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060103	9kHz~30MHz	Oct. 13, 2017	Feb. 02, 2018	Oct. 12, 2018	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060105	9kHz~30MHz	Oct. 13, 2017	Feb. 02, 2018	Oct. 12, 2018	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 12, 2017	Feb. 02, 2018	Oct. 11, 2018	Conduction (CO01-KS)

NCR: No Calibration Required



5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	2.3dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	5.7dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	5.5dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	5.2dB
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Appendix A. Conducted Test Results

Report Number : FR7D1210E

Test Engineer:	Silent Hai	Temperature:	21~25	°C
Test Date:	2018/3/4~2018/3/5	Relative Humidity:	51~55	%

TEST RESULTS DATA
6dB and 26dB EBW and 99% OBW

Band IV													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwidth (MHz)		26dB Bandwidth (MHz)		6 dB Bandwidth (MHz)		6 dB Bandwidth Min. Limit (MHz)		Pass/Fail
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	149	5745	17.58		25.03		15.52		0.5	0.5	Pass
11a	6Mbps	1	157	5785	17.58		24.63		15.52		0.5	0.5	Pass
11a	6Mbps	1	165	5825	17.53		24.93		15.52		0.5	0.5	Pass
HT20	MCS0	2	149	5745	18.73	18.68	25.52	24.58	16.54	15.94	0.5		Pass
HT20	MCS0	2	157	5785	18.68	18.83	25.38	25.03	16.78	16.74	0.5		Pass
HT20	MCS0	2	165	5825	18.63	18.73	24.38	25.33	15.94	16.52	0.5		Pass
HT40	MCS0	2	151	5755	36.56	36.36	41.99	41.81	35.72	35.13	0.5		Pass
HT40	MCS0	2	159	5795	36.56	36.56	41.90	41.99	35.28	35.72	0.5		Pass
VHT80	MCS0	2	155	5775	75.64	75.76	83.44	83.76	75.12	75.13	0.5		Pass

TEST RESULTS DATA
Average Power Table

Band IV														
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)		Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		Pass/Fail
					Ant 1	Ant 2	Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	149	5745	0.20	0.22	16.32	16.81		30.00	30.00	0.10	1.10	Pass
11a	6Mbps	1	157	5785	0.20	0.22	16.56	16.17		30.00	30.00	0.10	1.10	Pass
11a	6Mbps	1	165	5825	0.20	0.22	17.09	17.05		30.00	30.00	0.10	1.10	Pass
HT20	MCS0	2	149	5745	0.23	0.25	14.46	15.75	18.17	30.00		1.10		Pass
HT20	MCS0	2	157	5785	0.23	0.25	14.71	15.26	18.01	30.00		1.10		Pass
HT20	MCS0	2	165	5825	0.23	0.25	15.19	16.09	18.68	30.00		1.10		Pass
HT40	MCS0	2	151	5755	0.42	0.43	14.83	16.03	18.48	30.00		1.10		Pass
HT40	MCS0	2	159	5795	0.42	0.43	15.03	15.84	18.46	30.00		1.10		Pass
VHT80	MCS0	2	155	5775	0.78	0.78	15.03	15.89	18.49	30.00		1.10		Pass

TEST RESULTS DATA
Power Spectral Density

Band IV																
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)		10log (500kHz /RBW) Factor (dB)		Average Power Density (dBm/500kHz)			Average PSD Limit (dBm/500kHz)		DG (dBi)		Pass /Fail
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	149	5745	0.20	0.22	2.22	2.22	3.11			30.00	30.00	0.10	1.10	Pass
11a	6Mbps	1	157	5785	0.20	0.22	2.22	2.22	3.25			30.00	30.00	0.10	1.10	Pass
11a	6Mbps	1	165	5825	0.20	0.22	2.22	2.22	3.84			30.00	30.00	0.10	1.10	Pass
HT20	MCS0	2	149	5745	0.23	0.25	2.22					5.45	30.00	3.62		Pass
HT20	MCS0	2	157	5785	0.23	0.25	2.22					4.76	30.00	3.62		Pass
HT20	MCS0	2	165	5825	0.23	0.25	2.22					5.87	30.00	3.62		Pass
HT40	MCS0	2	151	5755	0.42	0.43	2.22					3.05	30.00	3.62		Pass
HT40	MCS0	2	159	5795	0.42	0.43	2.22					2.01	30.00	3.62		Pass
VHT80	MCS0	2	155	5775	0.78	0.78	2.22					-0.66	30.00	3.62		Pass



Appendix B. Radiated Spurious Emission

Band 4 - 5725~5850MHz

WIFI 802.11a (Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 149 5745MHz		5633.6	49.11	-19.09	68.2	37.78	35.09	11.43	35.19	100	360	P	H
		5695.4	52.93	-48.88	101.81	41.5	35.17	11.46	35.2	100	360	P	H
		5717.6	58.02	-52.11	110.13	46.51	35.21	11.5	35.2	100	360	P	H
		5725	61.82	-60.38	122.2	50.31	35.21	11.5	35.2	100	360	P	H
	*	5745	105.88	-	-	94.32	35.24	11.53	35.21	100	360	P	H
	*	5745	98.42	-	-	86.86	35.24	11.53	35.21	100	360	A	H
		5633.2	47.88	-20.32	68.2	36.55	35.09	11.43	35.19	232	96	P	V
		5686	49.46	-45.41	94.87	38.03	35.17	11.46	35.2	232	96	P	V
		5717.4	49.15	-60.92	110.07	37.66	35.19	11.5	35.2	232	96	P	V
		5724.4	56.67	-64.16	120.83	45.16	35.21	11.5	35.2	232	96	P	V
	*	5745	100.6	-	-	89.04	35.24	11.53	35.21	232	96	P	V
	*	5745	94.15	-	-	82.59	35.24	11.53	35.21	232	96	A	V



WIFI Ant. 2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a CH 157 5785MHz		5632	48.6	-19.6	68.2	37.29	35.07	11.43	35.19	100	360	P	H
		5698.8	49.99	-54.33	104.32	38.56	35.17	11.46	35.2	100	360	P	H
		5712.4	51.42	-57.25	108.67	39.93	35.19	11.5	35.2	100	360	P	H
		5724	47.76	-72.16	119.92	36.25	35.21	11.5	35.2	100	360	P	H
	*	5785	104.97	-	-	93.34	35.29	11.56	35.22	100	360	P	H
	*	5785	96.73	-	-	85.1	35.29	11.56	35.22	100	360	A	H
		5850.2	49.91	-71.83	121.74	38.16	35.38	11.6	35.23	100	360	P	H
		5862.4	49.46	-59.27	108.73	37.64	35.41	11.65	35.24	100	360	P	H
		5906.2	49.56	-32.52	82.08	37.63	35.48	11.69	35.24	100	360	P	H
		5942.8	49.62	-18.58	68.2	37.6	35.53	11.74	35.25	100	360	P	H
		5626.8	48.44	-19.76	68.2	37.12	35.07	11.43	35.18	228	98	P	V
		5687.6	48.78	-47.27	96.05	37.35	35.17	11.46	35.2	228	98	P	V
		5715.8	48.92	-60.71	109.63	37.43	35.19	11.5	35.2	228	98	P	V
		5721.4	47.79	-66.2	113.99	36.28	35.21	11.5	35.2	228	98	P	V
	*	5785	101.91	-	-	90.28	35.29	11.56	35.22	228	98	P	V
	*	5785	93.35	-	-	81.72	35.29	11.56	35.22	228	98	A	V
		5850.8	48.26	-72.12	120.38	36.51	35.38	11.6	35.23	228	98	P	V
		5864.8	49.15	-58.9	108.05	37.33	35.41	11.65	35.24	228	98	P	V
		5920.2	50.29	-21.45	71.74	38.36	35.48	11.69	35.24	228	98	P	V
		5941.4	49.59	-18.61	68.2	37.57	35.53	11.74	35.25	228	98	P	V



WIFI Ant. 2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a CH 165 5825MHz	*	5825	105.02	-	-	93.28	35.36	11.6	35.22	100	360	P	H
	*	5825	96.83	-	-	85.09	35.36	11.6	35.22	100	360	A	H
		5852.6	60.17	-56.1	116.27	48.42	35.38	11.6	35.23	100	360	P	H
		5858.2	51.62	-58.28	109.9	39.85	35.41	11.6	35.24	100	360	P	H
		5891.4	51.21	-41.82	93.03	39.34	35.46	11.65	35.24	100	360	P	H
		5947.4	50.8	-17.4	68.2	38.78	35.53	11.74	35.25	100	360	P	H
	*	5825	102.39	-	-	90.65	35.36	11.6	35.22	227	98	P	V
	*	5825	93.5	-	-	81.76	35.36	11.6	35.22	227	98	A	V
		5851.8	51.5	-66.6	118.1	39.75	35.38	11.6	35.23	227	98	P	V
		5869	49.8	-57.08	106.88	37.98	35.41	11.65	35.24	227	98	P	V
		5914.4	50.22	-25.8	76.02	38.29	35.48	11.69	35.24	227	98	P	V
		5944.6	49.21	-18.99	68.2	37.19	35.53	11.74	35.25	227	98	P	V
Remark	1. No other spurious found.												
	2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI Ant. 2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a CH 149 5745MHz		11490	44.28	-29.72	74	45.14	38.38	17.66	57.34	100	0	P	H
		17235	48.14	-20.06	68.2	40.91	41.77	20.83	55.8	100	0	P	H
		11490	44.43	-29.57	74	45.29	38.38	17.66	57.34	100	0	P	V
		17235	47.17	-21.03	68.2	39.94	41.77	20.83	55.8	100	0	P	V
802.11a CH 157 5785MHz		11570	43.96	-30.04	74	44.53	38.46	17.76	57.19	100	0	P	H
		17355	48.87	-19.33	68.2	41.71	41.61	20.93	55.8	100	0	P	H
		11570	43.87	-30.13	74	44.44	38.46	17.76	57.19	100	0	P	V
		17355	48.03	-20.17	68.2	40.87	41.61	20.93	55.8	100	0	P	V
802.11a CH 165 5825MHz		11650	43.44	-30.56	74	43.74	38.51	17.86	57.08	100	0	P	H
		17475	47.21	-20.99	68.2	40.13	41.45	21.03	55.8	100	0	P	H
		11650	43.59	-30.41	74	43.89	38.51	17.86	57.08	100	0	P	V
		17475	48.51	-19.69	68.2	41.43	41.45	21.03	55.8	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

Band 4 - 5725~5850MHz

WIFI 802.11n HT20 (Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preampl	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11n HT20 CH 149 5745MHz		5635	48.04	-20.16	68.2	36.71	35.09	11.43	35.19	100	360	P	H
		5697	50.79	-52.2	102.99	39.36	35.17	11.46	35.2	100	360	P	H
		5719.8	54.41	-56.33	110.74	42.9	35.21	11.5	35.2	100	360	P	H
		5723.2	64.99	-53.11	118.1	53.48	35.21	11.5	35.2	100	360	P	H
	*	5745	110.5	-	-	98.94	35.24	11.53	35.21	100	360	P	H
	*	5745	103.28	-	-	91.72	35.24	11.53	35.21	100	360	A	H
		5638	48.81	-19.39	68.2	37.48	35.09	11.43	35.19	238	96	P	V
		5679.4	49.26	-40.74	90	37.86	35.14	11.46	35.2	238	96	P	V
		5720	54.92	-55.88	110.8	43.41	35.21	11.5	35.2	238	96	P	V
		5723	62.33	-55.31	117.64	50.82	35.21	11.5	35.2	238	96	P	V
	*	5745	104.56	-	-	93	35.24	11.53	35.21	238	96	P	V
	*	5745	98.28	-	-	86.72	35.24	11.53	35.21	238	96	A	V



WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 157 5785MHz		5634	49.37	-18.83	68.2	38.04	35.09	11.43	35.19	100	360	P	H
		5657	48.51	-24.89	73.4	37.15	35.12	11.43	35.19	100	360	P	H
		5706	48.84	-58.04	106.88	37.35	35.19	11.5	35.2	100	360	P	H
		5722.6	49.35	-67.38	116.73	37.84	35.21	11.5	35.2	100	360	P	H
	*	5785	109.18	-	-	97.55	35.29	11.56	35.22	100	360	P	H
	*	5785	101.76	-	-	90.13	35.29	11.56	35.22	100	360	A	H
		5850.4	49.18	-72.11	121.29	37.43	35.38	11.6	35.23	100	360	P	H
		5869.6	49.23	-57.48	106.71	37.41	35.41	11.65	35.24	100	360	P	H
		5914.6	49.47	-26.4	75.87	37.54	35.48	11.69	35.24	100	360	P	H
		5945.4	49.22	-18.98	68.2	37.2	35.53	11.74	35.25	100	360	P	H
		5645.8	47.99	-20.21	68.2	36.66	35.09	11.43	35.19	277	96	P	V
		5686.6	49.34	-45.98	95.32	37.91	35.17	11.46	35.2	277	96	P	V
		5714.2	48.58	-60.6	109.18	37.09	35.19	11.5	35.2	277	96	P	V
		5723.2	47.62	-70.48	118.1	36.11	35.21	11.5	35.2	277	96	P	V
	*	5785	103.54	-	-	91.91	35.29	11.56	35.22	277	96	P	V
	*	5785	96.34	-	-	84.71	35.29	11.56	35.22	277	96	A	V
		5850.4	48.21	-73.08	121.29	36.46	35.38	11.6	35.23	277	96	P	V
		5856.4	49.52	-60.89	110.41	37.74	35.41	11.6	35.23	277	96	P	V
		5893	50.3	-41.54	91.84	38.43	35.46	11.65	35.24	277	96	P	V
		5949	49.91	-18.29	68.2	37.89	35.53	11.74	35.25	277	96	P	V



WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 165 5825MHz	*	5825	109.72	-	-	97.98	35.36	11.6	35.22	100	360	P	H
	*	5825	101.75	-	-	90.01	35.36	11.6	35.22	100	360	A	H
		5850	58.77	-63.43	122.2	47.02	35.38	11.6	35.23	100	360	P	H
		5859	53.46	-56.22	109.68	41.69	35.41	11.6	35.24	100	360	P	H
		5881.4	50.96	-49.49	100.45	39.12	35.43	11.65	35.24	100	360	P	H
		5926.4	50.92	-17.28	68.2	38.97	35.5	11.69	35.24	100	360	P	H
	*	5825	104.39	-	-	92.65	35.36	11.6	35.22	262	98	P	V
	*	5825	97.68	-	-	85.94	35.36	11.6	35.22	262	98	A	V
		5850	55.32	-66.88	122.2	43.57	35.38	11.6	35.23	262	98	P	V
		5864.6	50.62	-57.49	108.11	38.8	35.41	11.65	35.24	262	98	P	V
		5911.2	50.97	-27.41	78.38	39.04	35.48	11.69	35.24	262	98	P	V
		5939	50.32	-17.88	68.2	38.35	35.53	11.69	35.25	262	98	P	V
Remark		1. No other spurious found. 2. All results are PASS against Peak and Average limit line.											



Band 4 5725~5850MHz
WIFI 802.11n HT20 (Harmonic @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 149 5745MHz		11490	44.49	-29.51	74	45.35	38.38	17.66	57.34	100	0	P	H
		17235	47.42	-20.78	68.2	40.19	41.77	20.83	55.8	100	0	P	H
		11490	44.85	-29.15	74	45.71	38.38	17.66	57.34	100	0	P	V
		17235	47.73	-20.47	68.2	40.5	41.77	20.83	55.8	100	0	P	V
802.11n HT20 CH 157 5785MHz		11570	44.66	-29.34	74	45.23	38.46	17.76	57.19	100	0	P	H
		17355	47.74	-20.46	68.2	40.58	41.61	20.93	55.8	100	0	P	H
		11570	44.13	-29.87	74	44.7	38.46	17.76	57.19	100	0	P	V
		17355	47.64	-20.56	68.2	40.48	41.61	20.93	55.8	100	0	P	V
802.11n HT20 CH 165 5825MHz		11650	44.33	-29.67	74	44.63	38.51	17.86	57.08	100	0	P	H
		17475	47.59	-20.61	68.2	40.51	41.45	21.03	55.8	100	0	P	H
		11650	44.66	-29.34	74	44.96	38.51	17.86	57.08	100	0	P	V
		17475	48.65	-19.55	68.2	41.57	41.45	21.03	55.8	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11n HT40 (Band Edge @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 151 5755MHz		5603.8	49.5	-18.7	68.2	38.24	35.04	11.4	35.18	100	360	P	H
		5697.4	54.49	-48.79	103.28	43.06	35.17	11.46	35.2	100	360	P	H
		5719.8	68.97	-41.77	110.74	57.46	35.21	11.5	35.2	100	360	P	H
		5720.8	71.27	-41.35	112.62	59.76	35.21	11.5	35.2	100	360	P	H
	*	5755	107.54	-	-	95.96	35.26	11.53	35.21	100	360	P	H
	*	5755	99.53	-	-	87.95	35.26	11.53	35.21	100	360	A	H
		5850.8	49.8	-70.58	120.38	38.05	35.38	11.6	35.23	100	360	P	H
		5874.4	50.42	-54.95	105.37	38.58	35.43	11.65	35.24	100	360	P	H
		5915	50.14	-25.43	75.57	38.21	35.48	11.69	35.24	100	360	P	H
		5945.4	49.82	-18.38	68.2	37.8	35.53	11.74	35.25	100	360	P	H
		5634.2	50.03	-18.17	68.2	38.7	35.09	11.43	35.19	268	97	P	V
		5700	50.48	-54.72	105.2	39.05	35.17	11.46	35.2	268	97	P	V
		5705	60.06	-46.54	106.6	48.57	35.19	11.5	35.2	268	97	P	V
		5723.2	69.43	-48.67	118.1	57.92	35.21	11.5	35.2	268	97	P	V
	*	5755	102.26	-	-	90.68	35.26	11.53	35.21	268	97	P	V
	*	5755	94.85	-	-	83.27	35.26	11.53	35.21	268	97	A	V
		5855	48.63	-62.17	110.8	36.85	35.41	11.6	35.23	268	97	P	V
		5856.8	49.13	-61.17	110.3	37.35	35.41	11.6	35.23	268	97	P	V
		5875.4	51.48	-53.42	104.9	39.64	35.43	11.65	35.24	268	97	P	V
		5928.2	50.29	-17.91	68.2	38.34	35.5	11.69	35.24	268	97	P	V



WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 159 5795MHz		5625.2	49.73	-18.47	68.2	38.41	35.07	11.43	35.18	100	360	P	H
		5692	48.96	-50.34	99.3	37.53	35.17	11.46	35.2	100	360	P	H
		5718	49.02	-61.22	110.24	37.51	35.21	11.5	35.2	100	360	P	H
		5724.6	50.6	-70.69	121.29	39.09	35.21	11.5	35.2	100	360	P	H
	*	5795	107.3	-	-	95.65	35.31	11.56	35.22	100	360	P	H
	*	5795	99.17	-	-	87.52	35.31	11.56	35.22	100	360	A	H
		5850.8	49.89	-70.49	120.38	38.14	35.38	11.6	35.23	100	360	P	H
		5855.8	53.35	-57.23	110.58	41.57	35.41	11.6	35.23	100	360	P	H
		5915.2	58.18	-17.25	75.43	46.25	35.48	11.69	35.24	100	360	P	H
		5935.4	51.33	-16.87	68.2	39.39	35.5	11.69	35.25	100	360	P	H
		5613.2	48.85	-19.35	68.2	37.59	35.04	11.4	35.18	262	98	P	V
		5693.2	49.52	-50.67	100.19	38.09	35.17	11.46	35.2	262	98	P	V
		5717.6	51.39	-58.74	110.13	39.88	35.21	11.5	35.2	262	98	P	V
		5723.8	49.42	-70.04	119.46	37.91	35.21	11.5	35.2	262	98	P	V
	*	5795	102.29	-	-	90.64	35.31	11.56	35.22	262	98	P	V
	*	5795	94.66	-	-	83.01	35.31	11.56	35.22	262	98	A	V
		5851.4	53.21	-65.8	119.01	41.46	35.38	11.6	35.23	262	98	P	V
		5866.4	50.32	-57.29	107.61	38.5	35.41	11.65	35.24	262	98	P	V
		5921	50.39	-20.76	71.15	38.46	35.48	11.69	35.24	262	98	P	V
		5945.6	48.88	-19.32	68.2	36.86	35.53	11.74	35.25	262	98	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz
WIFI 802.11n HT40 (Harmonic @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 151 5755MHz		11510	44.66	-29.34	74	45.43	38.4	17.71	57.3	100	0	P	H
		17265	47.6	-20.6	68.2	40.38	41.73	20.86	55.8	100	0	P	H
		11510	46.53	-27.47	74	47.3	38.4	17.71	57.3	100	0	P	V
		17265	47.41	-20.79	68.2	40.19	41.73	20.86	55.8	100	0	P	V
802.11n HT40 CH 159 5795MHz		11590	45.18	-28.82	74	45.67	38.47	17.81	57.16	100	0	P	H
		17385	47.08	-21.12	68.2	39.94	41.56	20.96	55.8	100	0	P	H
		11590	44.29	-29.71	74	44.78	38.47	17.81	57.16	100	0	P	V
		17385	47.83	-20.37	68.2	40.69	41.56	20.96	55.8	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT80 CH 155 5775MHz		5649.8	48.47	-19.73	68.2	37.11	35.12	11.43	35.19	107	360	P	H
		5698.4	63.33	-40.69	104.02	51.9	35.17	11.46	35.2	107	360	P	H
		5720	71.22	-39.58	110.8	59.71	35.21	11.5	35.2	107	360	P	H
		5720	71.22	-39.58	110.8	59.71	35.21	11.5	35.2	107	360	P	H
	*	5775	104.36	-	-	92.76	35.29	11.53	35.22	107	360	P	H
	*	5775	96.77	-	-	85.17	35.29	11.53	35.22	107	360	A	H
		5854.4	60.65	-51.52	112.17	48.87	35.41	11.6	35.23	107	360	P	H
		5871.2	67.3	-38.96	106.26	55.46	35.43	11.65	35.24	107	360	P	H
		5877.4	58.63	-44.79	103.42	46.79	35.43	11.65	35.24	107	360	P	H
		5934.2	49.71	-18.49	68.2	37.76	35.5	11.69	35.24	107	360	P	H
		5618	48.78	-19.42	68.2	37.49	35.07	11.4	35.18	248	97	P	V
		5684	56.97	-36.43	93.4	45.54	35.17	11.46	35.2	248	97	P	V
		5707.8	62.27	-45.12	107.39	50.78	35.19	11.5	35.2	248	97	P	V
		5723.4	65.85	-52.7	118.55	54.34	35.21	11.5	35.2	248	97	P	V
	*	5775	99.93	-	-	88.33	35.29	11.53	35.22	248	97	P	V
	*	5775	92.22	-	-	80.62	35.29	11.53	35.22	248	97	A	V
		5850.2	60.07	-61.67	121.74	48.32	35.38	11.6	35.23	248	97	P	V
		5861.8	62.96	-45.93	108.89	51.14	35.41	11.65	35.24	248	97	P	V
		5884.4	54.29	-43.93	98.22	42.45	35.43	11.65	35.24	248	97	P	V
		5936	50.23	-17.97	68.2	38.29	35.5	11.69	35.25	248	97	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11ac VHT80 (Harmonic @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac		11550	44.29	-29.71	74	44.9	38.44	17.76	57.22	100	0	P	H
VHT80		17325	47.23	-20.97	68.2	40.05	41.66	20.9	55.8	100	0	P	H
CH 155		11550	44.67	-29.33	74	45.28	38.44	17.76	57.22	100	0	P	V
5775MHz		17325	48.7	-19.5	68.2	41.52	41.66	20.9	55.8	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Emission below 1GHz

5GHz WIFI 802.11n HT40 (LF @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
5GHz 802.11n HT40 LF		30.81	27.67	-12.33	40	33.74	24.09	1.2	31.36	-	-	P	H
		192.27	30.18	-13.32	43.5	44.57	14.78	2.18	31.46	-	-	P	H
		273.81	22.44	-23.56	46	32.04	19.01	2.66	31.34	-	-	P	H
		862.8	32.79	-13.21	46	29.51	29.01	4.58	30.55	-	-	P	H
		911.1	34.42	-11.58	46	31.07	28.96	4.64	30.52	-	-	P	H
		956.6	34.74	-11.26	46	29.53	30.69	4.71	30.51	100	0	P	H
		30.27	28.34	-11.66	40	33.89	24.6	1.2	31.35	-	-	P	V
		165.54	27.35	-16.15	43.5	40.63	15.95	2.06	31.49	-	-	P	V
		246.27	30.64	-15.36	46	41.6	17.91	2.42	31.38	-	-	P	V
		631.1	34.68	-11.32	46	35.5	25.92	3.89	30.78	100	0	P	V
		746.6	32.51	-13.49	46	31.06	27.73	4.18	30.64	-	-	P	V
		958.7	34.17	-11.83	46	28.85	30.8	4.71	30.51	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

**Note symbol**

*	Fundamental Frequency which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is over limit line.
P/A	P eak or A verage
H/V	H orizontal or V ertical



A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
CH 01													
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)
 = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
 = 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)
 = 55.45 (dBμV/m)
2. Over Limit(dB)
 = Level(dBμV/m) – Limit Line(dBμV/m)
 = 55.45(dBμV/m) – 74(dBμV/m)
 = -18.55(dB)

For Average Limit @ 2390MHz:

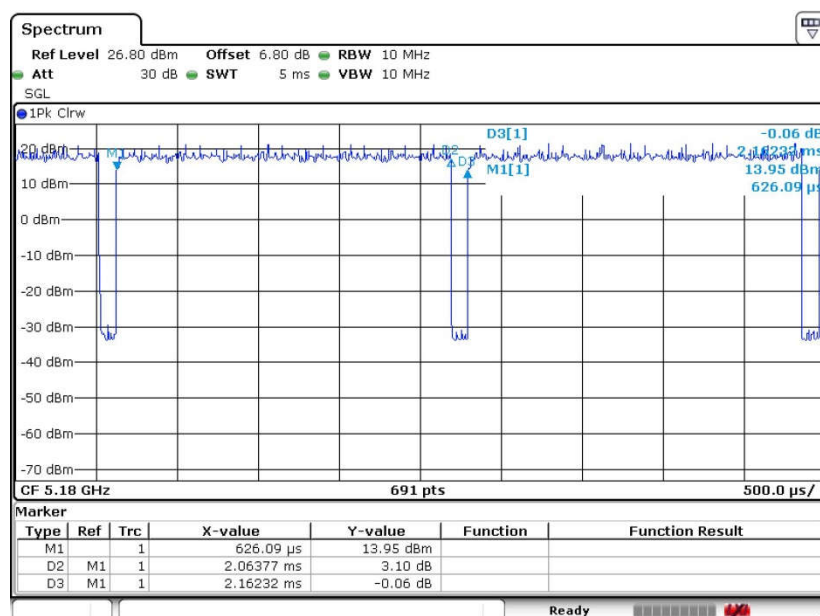
1. Level(dBμV/m)
 = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
 = 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)
 = 43.54 (dBμV/m)
2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)
 = 43.54(dBμV/m) – 54(dBμV/m)
 = -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.

Appendix C. Duty Cycle Plots

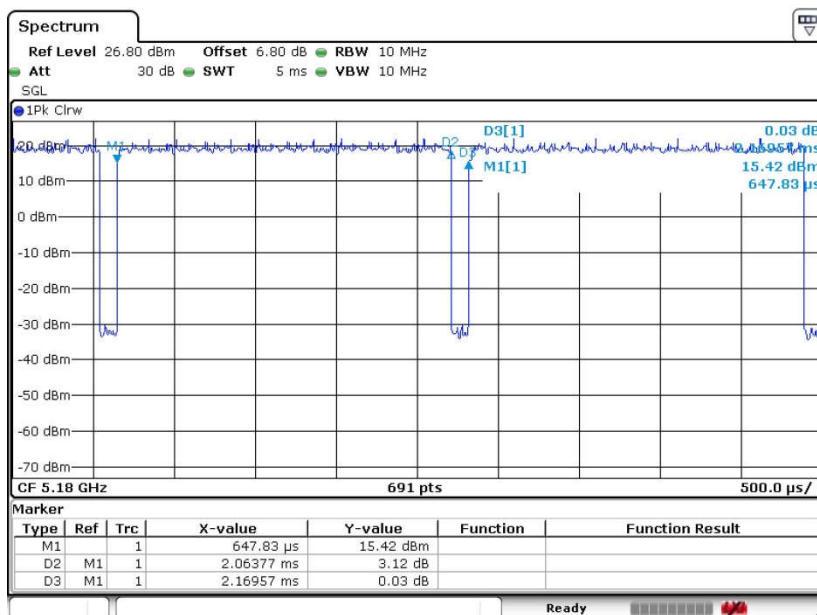
Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11a for Ant 1	95.44	2.064	0.485	1 kHz
802.11a for Ant 2	95.12	2.064	0.485	1 kHz
802.11n HT20 for Ant 1+2	94.79	1.926	0.519	1 kHz
802.11n HT40 for Ant 1+2	90.83	0.948	1.055	3 kHz
802.11ac VHT80 for Ant 1+2	83.55	0.464	2.156	3 KHz

802.11a for Ant 1

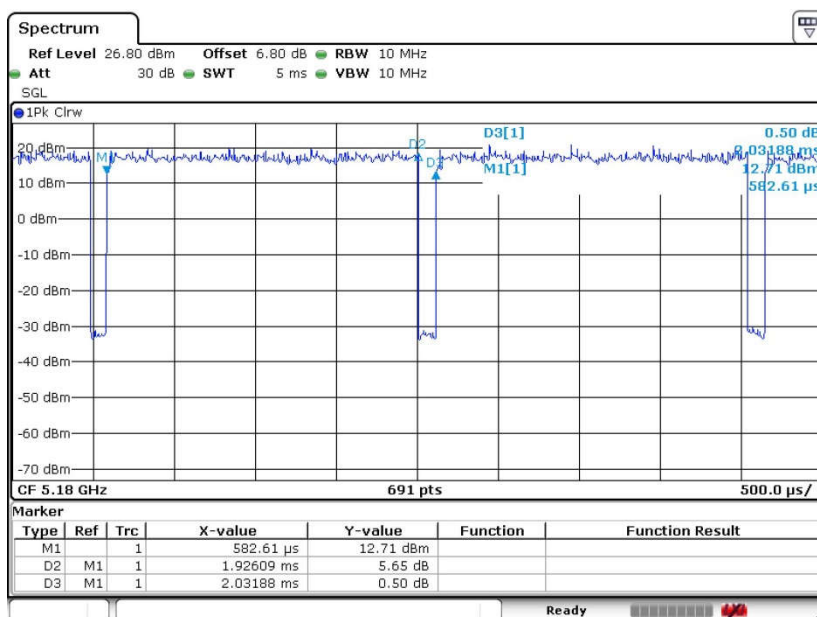




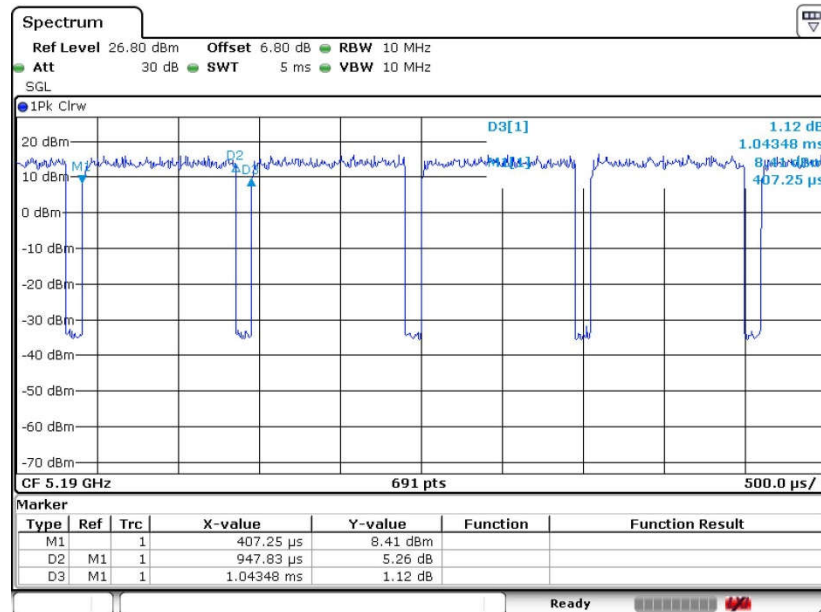
802.11a for Ant 2



802.11n HT20 for Ant 1+2



802.11n HT40 for Ant 1+2



802. 11ac VHT80 for Ant 1+2

